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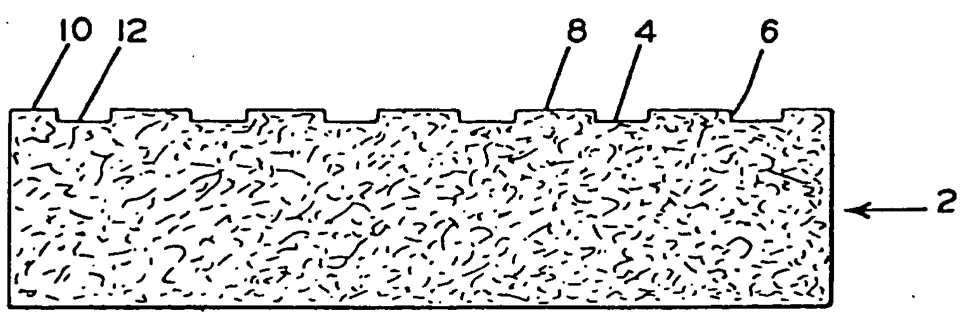
(54) Acoustical ceiling board

(57) An acoustical ceiling board 2 in which both the decorative appearance of the ceiling board and its acoustical properties are produced by a series of grooves 4 cut in the board surface. The porosity of the board material and the amount of vertical exposed surface 6 in the decorative pattern gives a desired acoustical rating without the pin-punched or fissured perforations needed with most mineral fibre ceiling boards to secure the desired acoustical rating.



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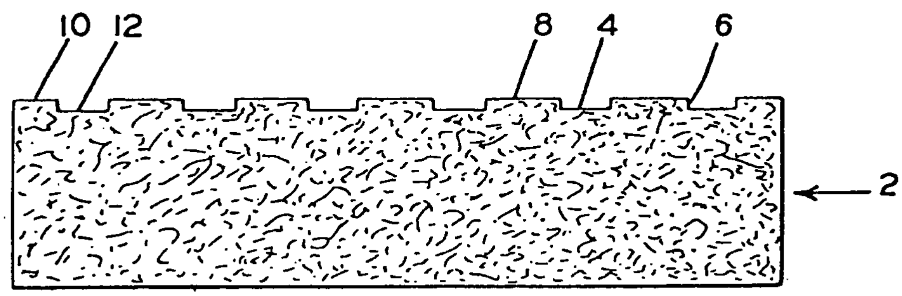

SPECIFICATION

Ac ustical ceiling board

The invention relates to ceiling boards and, more particularly, a ceiling board that has an acoustical property without the conventional pin punched perforations normally provided in acoustical ceiling board.

Ceiling panels with grooves in their face are shown in United States Design Patent No. 238,573 and in United States Design Patent No. 249,367.

In addition, United States Patent No. 3,470,977 shows an acoustical panel having short slits cut into the front face of the panel. Furthermore, it is known in the marketplace that there are a number of ceiling boards which have heavily scored surfaces. However, none of the previously proposed scored building products known to the inventor of the present invention are capable of securing a desired acoustical rating without the utilization of acoustical pin-punched perforations which tend to detract aesthetically from the decorative effect of a grooved board having plain linear geometric patterns.

The invention is directed to an acoustical ceiling board comprising a mineral fibre board structure having a porosity such that the board will have an air flow resistance of approximately 1200 cgs rayls (g.cm^{-2}s^{-1}) or less, according to a modified test method using the Leonard Air Flow Apparatus described in the article by R.W. Leonard appearing in The Journal of the Acoustical Society of America, Volume No. 17, page 240, 1946, so as to achieve a Noise Reduction Coefficient (NRC) rating of from 0.50 to 0.55, when tested according to American Society for Testing and Materials Standard No. ASTM C423–77, Sound Absorption of Acoustical Materials in Reverberation Rooms. A decorative pattern is placed on one surface of the board, and this pattern is a number of grooves cut in the surface of the board. The grooves are provided with side walls perpendicular to the plane of the board. The side walls of the grooves, and therefore the grooves, are of such a number and size as to provide at least about 50 square inches of side wall area per square foot of board surface (0.35 m^2/m^2).

One form of ceiling board constructed in accordance with the invention will now be described by way of example with reference to the accompanying drawing, the single figure of which is a cross-sectional view of the ceiling board.

Referring to the drawing, an acoustical ceiling board 2 is made of a min ral fibre structure which is approximat ly 3/4 of an inch (19mm) thick. On th face of th ceiling board as shown in the drawing th r is provided a decorative pattern on this surface of th board. Th pattern is a number of grooves 4 cut in the surface of the board, and the grooves xtend parallel to one another from one side of the board to the other. These grooves 4 are formed with side walls 6 which are perpendicular to the plane 8 of the ceilinng board 2. As shown in the drawing, the grooves are 1/8 of an inch (3 mm) deep and are 1/4 of an inch (6.5mm) wide and are spaced 3/8 of an inch (9.5mm) apart. The grooves in the drawing are such that the side wall area of the pattern shown is such that there is formed 50 square inches of side wall area per square foot of board surface (0.35m^2/m^2). The ceiling board is provided with a paint coat which is normally sprayed on the ceiling board. The paint coat(s) would be applied to the raised areas 10 and the depressed areas 12 which are either in or parallel to the plane of the ceiling board. These areas are not capable of functioning as efficient sound absorbing surfaces. The painting of the surface of the board provides these flat areas with a smooth untextured surface. Since the grooves are in the ceiling board, the side walls of the ceiling board do not have a smooth surface and are somewhat open in nature, and this open structure is not plugged by the paint coat applied to the board. In addition, the nature of the board is such, because it is made on a fourdrinier machine, that it has a lesser air flow resistance measured across the board and a greater air flow resistance measured through the board perpendicular to the surface 8.

The invention provides an acoustical ceiling product unique in that both the decorative appearance of the panel and its acoustical properties are produced by cutting a series of grooves in the board surface. The cutting process is called a "rilling" process wherein a series of cutters cut the grooves in the board. Whereas the surface of most conventional ceiling boards are perforated with pins or fissuring dies, for acoustical purposes, the board described herein achieves its desired acoustical properties by rilling. While in many conventional ceiling products the board perforations are necessary for sound absorption and are sometimes decorative, there are certain products where the perforation detracts from the appearance. In those instances, where perforations are not desirable, the ceiling board manufacturer may try to disguise the perforations by covering the board surfaces with an acoustically transparent material, such as a fabric or thin film, or by positioning th perforations so that they blend in with an mbossed or printed decorativ surface pattern. With th product described herein it is desir d to achiev a plain linear geometric pattern on an untextured surface, and here the perforations would comp te with the visual objectiv of th ceiling. A conventional board formulation for a c iling product

would be as listed below.

Ingredients	*Percent by Weight*
mineral fibr	73–84%
organic fibre	5–4%
starch	7–6%
clay	15–5%

The above provides the basic ingredients of a mineral wool fibre board and the approximate range in which these products appear. In many cases, the mineral fibre ingredient is composed of virgin mineral fibre and "broke", which is scrap processed ceiling board being recycled back into a new ceiling board. Broke, in particular, has fine particulate matter in it and this fine particulate matter will affect the board's porosity. Listed below are two board structures referred to as Formula 1 and Formula 2. Both boards have the same material composition as that set out above for board formulation. However, in Formula 2, 27.5 percent of the ingredients is provided by broke. In Formula 1, broke amounts to only 20.0 percent of the ingredients provided, and such broke was processed to remove dust particles and, therefore, Formula 1 has less fine particulate matter. Considering the two products described above, their acoustical ratings are as follows:

	Cgs Rayls	*NRC (4 Freq. Avg.)*
Formula 1	1220	0.54
Formula 2	2280	0.42

Sound absorption is dependent on the porosity of the board formulation and on the amount of surface area exposed to the sound source. When comparing a perforated pattern to a rilled pattern, both products have vertical surfaces which will affect the acoustical rating and the horizontal surfaces of both patterns will have minimal affect upon the acoustical rating. The porosity of the board must give an air flow resistance (AFR) of approximately 1200 cgs rayls or less. As can be seen in the above formula 1—Formula 2 examples, when a product has the 1220 cgs rayls rating, it can achieve an NRC of 0.54 which is an acceptable rating to permit one to call the product an acoustical product. When the air flow resistance increases as in Formula 2, the NRC goes down and the product shown in Formula 2 is not considered an effective acoustical product.

While many conventional mineral fibre board f rmulations, wh n perforat d in a normal mann r, will provide an NRC in the 0.55–0.65 range, these formulations were found to produce an ssentially non-ac ustical product when rilled only. Consequently, the rilling alon do s not contribut t the desired acoustical rating. It is the rilling with th desir d amount of open vertical surface plus a certain air flow resistance for the board that gives the desired combination to produce acoustical rilled ceiling board.

CLAIMS

1. An acoustical ceiling board comprising: a mineral fibre board structure having a porosity such that the board will have an air flow resistance of approximately 1200 cgs rayls or less, having a number of grooves cut in one face of the board, the grooves having side walls perpendicular to the plane of said one surface; the said side walls of the said grooves being of such a number and size that their total area is at least 0.35 of the surface area of the board.

2. An acoustical ceiling board as claimed in claim 1, wherein the grooves of the pattern are parallel to each other.

3. An acoustical ceiling board as claimed in claim 2, wherein the grooves cut in the ceiling board are about 6.35 mm wide and about 3.2 mm deep and are spaced about 9.5 mm apart.

4. An acoustical ceiling board as claimed in any one of claims 1 to 3, wherein the horizontal surface of the said face of the ceiling board in the plane of the face or parallel to the plane of the face are smooth and untextured on their surfaces and the side walls of the said grooves of the ceiling board are perpendicular to the said smooth untextured surfaces.

5. An acoustical ceiling board substantially as hereinbefore described with reference to, and as shown in, the accompanying drawing.

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